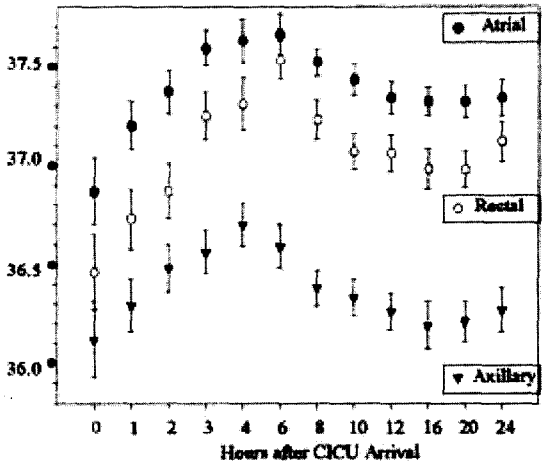
4:15 p.m.

863-2 **Intracardiac Temperature Monitoring in Infants Following Congenital Heart Surgery**

Sarah Tabbutt, Richard Ittenbach, Susan C. Nicolson, Nancy Burnham, Shannon Hittle, Thomas L. Spray, J. William Gaynor, The Children's Hospital of Philadelphia, University of Pennsylvania School of Medicine, Philadelphia, PA

Background: Hyperthermia following cerebral ischemia is associated with worse neurological outcome. Our goal was to compare post-operative intracardiac temperature to traditional monitoring in infants. **Methods**: Sequential temperature data was collected in 50 infants undergoing open heart surgery. Intra-atrial thermister (T_{ATR}), nasopharyngeal (T_{NP}), esophageal (T_E), rectal (T_R), and axillary (T_{AX}) temperatures were recorded in all patients. **Results**: The age at surgery was 151 ± 186 days and the weight 5.3 ± 2.3 kg. Circulatory arrest was used for 26 patients. In the operating room, the maximum T_{ATR} (37.8 ± 0.6°C) was significantly greater than both the simultaneous T_{ES} (37.0 ± 2.1°C, p = .04) and T_{NP} (36.4 ± 2.9°C, p = .006). In the CICU, T_{ATR} was significantly greater than both T_{AX} and T_R (see Figure). Post-op day 1, T_{ATR} was greater than 38°C in 27 patients (54 %). **Conclusions**: Traditional methods of temperature monitoring significantly underestimate core temperature following cardiac surgery in infants. Intracardiac temperature monitoring may enable more accurate avoidance of cerebral hyperthermia.



4:30 p.m.

863-3 **Early Indicator for Deteriorating Outcome in Congenital Heart Surgery: The Sequential Safety Monitoring Procedure**

Marjon J. Noordzij, Alexandra B. Elgersma, Ingeborg van den Tweel, Francois J. Hitchcock, Ger B. Bennink, Erik J. Meijboom, University of Utrecht Medical Center, Utrecht, The Netherlands

Background: To monitor the outcome of congenital heart surgery, techniques should be implemented to provide continues evaluation. This study assessed the use of the sequential safety monitoring procedure as early indicator for deteriorating outcome.
Methods: Mortality and morbidity rates in 3 periods: 1988-1990, 1991-1995 and 1996-1999 in which 2 different surgical teams operated were evaluated retrospectively. ICU-stay, delayed sternal closure and phrenic nerve paralysis were associated markers of outcome, often considered as near miss situations. Standard descriptive analysis and analysis by the sequential safety monitoring procedure to identify trends were performed. The sequential safety monitoring procedure is an online technique providing case by case information and clear-cut preset alert and alarm boundaries. In this study an overall mortality rate of 4% was considered satisfactory, an increase by a factor 1.5 or more unacceptable.
Findings: In period 1 and 3 the same surgical team operated with respectively 5.8% and 4.4% mortality, overall 5.0% (1032/52). Mortality in period 2 was 9.9% (704/70), delayed sternal closure(N=59) was associated with increased mortality and prolonged ICU-stay(p=0.0005). Phrenic nerve paralyses (N=15) was associated with increased mortality and prolonged IC-stay. These retrospective data were evaluated in a prospective fashion, using the sequential safety monitoring procedure. The alert boundary would have been crossed in period 2 after 11 months (64 patients/mortality 7), the alarm boundary after 13 months (87 patients/mortality 11), indicating that the risk of mortality had increased by a factor 1.5 or more. In period 3 the cumulative points stayed well within both the alert and alarm boundary.
Conclusion: The sequential safety monitoring procedure provides accurate and early prospective detection of increasing mortality. It allows, even without requiring the use of near miss situations, timely intervention and prevention of further deterioration of surgical outcome.

4:45 p.m.

863-4 **Mechanism of Activation of Myocardial Apoptosis in the Post-Cardioplegic Neonatal Lamb Heart**

Lixing Wang Mohsen Karimi, James M. Hammel, Elesa W. Barner, Wei Gen Li, Thomas D. Scholz, Jeffrey L. Segar, Christopher A. Caldarone, University of Iowa, Iowa City, IA

Background: Cardiac surgery in the neonate is frequently followed by significant postoperative myocardial dysfunction in the early postoperative period. The underlying pathophysiologic mechanism is poorly understood but may be related to the vulnerability of neonatal myocardium to apoptosis. Our previous reports have demonstrated that apoptosis is detectable within six hours after cardioplegic arrest in the neonatal lamb and the neonatal heart is more susceptible to this process than the mature heart. In the present study, the upstream mediators of early postoperative apoptosis are further investigated in a neonatal lamb model examining the impact of cardioplegic arrest on that of cardiopulmonary bypass alone. **Method:** Neonatal lambs (age 6-8 days) underwent cardiopulmonary bypass alone (CPB, n=4) or cardiopulmonary bypass with cardioplegic arrest (CPB+CP, n=4). cardioplegic arrest was induced with cold hyperkalemic crystalloid cardioplegia delivered at 20-minute intervals for 60 minutes. All lambs were weaned from CPB (total bypass time 100 min) and allowed to recover for six hours. At the end of recovery, the hearts were excised and myocardium was examined by Western Blotting, and in vitro kinase activity assay.
Results: The activity of the apoptosis signal-regulating kinase 1 (ASK1) was increased in the CPB+CP group vs CPB-only . The active form of c-Jun NH2-terminal kinase (p-JNK) was also significantly increased in the CPB+CP group vs CPB-only (50.0±5.6 vs 19.5±7.5; P<0.05). More cleaved form of Caspase 3 was detected in the CPB+CP group (77.2±5.9 vs 32.0±16.5, P<0.05). **Conclusion:**. ASK1, JNK and caspase-3 activation is associated with apoptosis in the neonatal heart after cardioplegic arrest in the early postoperative period. These findings may pave a way for understanding of the mechanism contributing to postoperative myocardial dysfunction and provide a potential strategy for improved preservation during congenital heart surgery.

ORAL CONTRIBUTIONS

891 Imaging and Intervention in Congenital Heart Disease

Wednesday, April 02, 2003, 10:30 a.m.-Noon
McCormick Place, Room S104

10:30 a.m.

891-1 **Magnetic Resonance Angiography of Coronary Arteries and Peripheral Arteries in Infants and Young Children With Kawasaki Disease**

Giles W. Vick, III, Raja Muthupillai, Jason T. Su, John P. Kovalchin, Taylor Chung, Baylor College of Medicine, Houston, TX

Background: The highest risk of complications from Kawasaki disease occurs in infants and young children. Additional techniques for assessment of the arterial system in these patients may be clinically useful.
Purpose: To evaluate magnetic resonance angiography (MRA) of the coronary arteries and peripheral arteries in infants and young children with Kawasaki disease.
Methods: Twenty one MRA examinations were performed in 14 patients with Kawasaki disease. Patient ages ranged from 2 to 105 months (m= 22 +/- 31), and weights from 4.7 to 30 kg (m=10.9 +/- 7.8). All patients were sedated. Real time respiratory navigator technique was employed for respiratory compensation. A three dimensional segmented k-space gradient echo acquisition was synchronized to mid to late diastole with vectorcardiographic triggering. Additional T2-weighted black blood fast spin echo imaging was performed in 5 patients. All patients underwent at least one evaluation of the peripheral arterial system with gadolinium contrast-enhanced three dimensional angiography (CEMRA) employing the SENSE technique . Echocardiograms were compared with coronary MRA in all patients.
Results: Good quality coronary MRA and CEMRA studies were obtained in all patients. There were no complications from the studies. Proximal coronary artery diameter measurements obtained with MRA correlated well with echocardiographic coronary artery measurements. However, MRA demonstrated distal coronary artery regions that were often not well seen echocardiographically. Three patients with acute Kawasaki disease had increased signal intensity surrounding coronary artery aneurysm sites on T2 weighted images. Large peripheral (subclavian, axillary, and/or iliac) arterial aneurysms were seen in 4 patients with CEMRA.
Conclusion: 1. Real-time navigator MRA is an effective noninvasive alternative to echocardiography for coronary artery imaging in infants and young children with Kawasaki disease.
2. T2-weighted MRI may have a role in detecting acute or recurrent arterial inflammation in patients with Kawasaki disease.
3. Peripheral arterial aneurysms in patients with Kawasaki disease can be clearly defined by CEMRA.